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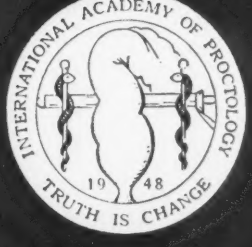
Caudal Intestine

Binocular Sigmoidoscope for Teaching Purposes

Sphincter-Saving Operations in Carcinoma of the Rectum

Hypertrophy of the Pyloric Muscle

OFFICIAL PUBLICATION OF THE INTERNATIONAL ACADEMY OF PROCTOLOGY



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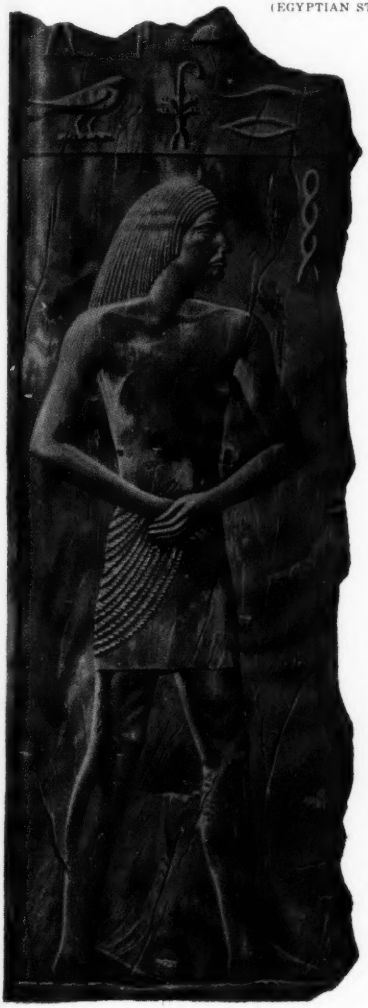

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LETTERS
To The Editor

This department is offered as an Open Forum for the discussion of topical medical issues. All letters must be signed. However, to protect the identity of writers who are invited to comment on controversial subjects, names will be omitted when requested.

Dear Sir:

I am not one of those who lightly take pen-in-hand to write letters to the Editor "pro bono publico," but I feel impelled to register disagreement with some of the statements in the guest Editorial by Dr. Paul Lahvis in your issue of October, 1958.

He states: "We are humbling the man who is better qualified to give good direct service than any limited specialist."

This depends upon what field the service is being given in. If the field is that of the specialist, I don't agree that the general practitioner can give better service in that field than the man who has made special study of it.

It is not necessary to limit the number of specialists being trained as he demands. This will automatically take place by virtue of the law of supply and demand, which has never been repealed. Also, the number of available residencies is limited.

I have the highest respect for the well qualified general practitioner. He does the really basically and numerically important work in Medicine. However,

—Concluded on page 26

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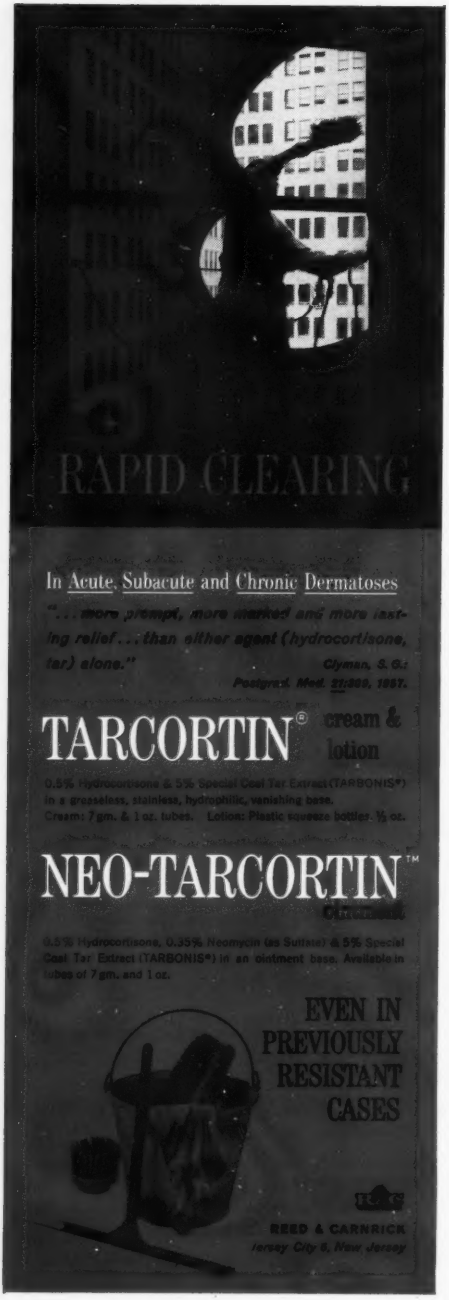
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LETTERS TO THE EDITOR

—Concluded from page 18

the field today is so vast that no one mind can encompass all of it. The specialist who has burrowed deeply into a single limited field is therefore essential. Unavoidably and naturally, most advances in Medicine, in diagnosis, therapy and in research, have emanated from the specialist.

With deepest respect for the sincere, capable and overworked general practitioner, the backbone of medical practice, let us not permit the pendulum to swing too far, as is usually its tendency, in the direction of down-grading the specialist. Let us not fall into the error of method which attempts to elevate the one by depreciating the other.

I agree with Dr. Lahvis that the G.P. should not be deprived of general hospital privileges. I believe that the American Medical Association has expressed this policy, although some hospitals act contrariwise. This latter, to my mind, is against public interest and forces the practitioner unwillingly to declare himself a partial specialist, interested primarily in one field, in order to gain hospital entree; but he wishes to be, and the public needs him to be, a true generalist.

To sum up: both types of minds, the general and the specializing, are essential to society and both, when they deserve it, should be accorded high respect and equal dignity and privilege.

Sincerely,
M.D.
Brooklyn, N. Y.

Caudal Intestine

Observations for a study of the act of defecation

ARTIGAS M. ESCUDERO, M.D., F.I.A.P.
Montevideo, Uruguay

The lower portion of the posterior wall of the rectum has special anatomical, physiological, clinical and pathological characteristics, different from the remainder of the rectal ampula; it represents the rest of the post-anal intestine and is an abbreviation of the caudal enteric appendix, a detailed study of which we propose to undertake as follows.

Embryology When the cloaca has been formed, its dorsal wall elongates itself on the caudal bud which has the three embryonic folds, being a lengthwise extension of the trunk, and appearing between the neurenteric canal and the anal membrane. According to the embryologists, digestive dependence terminates on the eighth week, but this termination is not completely achieved, and there remains between the dorsal wall of the rectum and the cranial edge of the anus, a pouch which will constitute the floor of the rectal ampulla in the orthogrades. It is curious to notice that this constant embryological formation never appears completely developed in any adult animal. Maybe its formation is due to induction or other phenomena which activate all of the blastodermic folds of the caudal zone, or else it could be an exaggeration of the intestinal angle taking place with the flexion of the posterior embryonic pole shown dorsally on the anal membrane. It is outlined in the child with a straight sacrococcyx, and attains fullest development in the adult or in the child having incomplete anal imperforation. (See plate 41 bis of Hillemand and others, "Les Maladies de l'Anus et du Canal Anal," 1955) In both cases, the requirements of life model out the post-anal intestine.

Anatomy The caudal intestine does not have definite limits, and post-mortem deformations make examination difficult. We consider as such the pouch formed by the posterior wall of the rectal ampulla, which corresponds to the coccyx and to the anococcygeus raphe. We could say it resembles a kidney-like recipient which surrounds, from behind and from the sides, the superior extreme of the anal canal. It is directed upwards and to the front. Its posterior and lateral walls are continued without very clear demarkation of limits by those

Work performed at the Faculty of Medicine of the University, and at the Pereira Rossell Hospital of the Ministry of Public Health, of Montevideo, Uruguay.

corresponding to the rectal ampulla. Its anterior concave border is brought upwards by the muscular anorectal ring.

Its mucous membrane shows the same characteristics as the remainder of the rectal mucous membrane, which is predominantly composed of lymphatic tissue.

The longitudinal layer, which is rarely uniform, forms a small sash and is the continuation of the posterior edge of the sigmoid, which spreads out in fan-like fashion, intercrossing itself with the anterior fibers, with which it forms arcades, with the addition of new muscular fibers. Upon this layer there grows cellular-fatty tissue containing the vessels and constituting the fascia rectalis.

Posterior Relations The posterior face of the rectum, which is convex, has its lower segment corresponding to the caudal intestine resting upon the sacrococcyx, the sacrosciatic ligaments and the retroanal segment of the levator ani.

The sacrum and the first piece of the coccyx form a nest for the rectal convexity, and the second piece of the coccyx composed of three or four vertebrae articulates itself to the first one by the means of an amphiarthrosis (called arthrodia by Cruveilhier), and is rarely ankilosed.

Laterally to the coccyx there is the iliococcygeus which is the bundle of the levator ani; ventrally there is the rectococcygeus of Treitz, caudally there is the group of formations known as anococcygeus raphe, the caudal end of which sheathe the bone.

The iliococcygeus muscle, which is inserted into the fasci of the internal obturator runs from the subpubial hole to the sciatic horn, and on this same horn it unfolds on a superficial plane, being fixed to the edges of the coccyx, as well as on a deeper plane which Uhlenhuth describes as lying upon the internal extreme of the superficial plane, and according to our observations, is often mistaken for the rectococcygeus of Treitz. According to Courtney the rectococcygeus and the iliococcygeus are fusioned, forming the ilio-rectococcygeus muscle. We have only seen the deep layer of the iliococcygeus fusioned with rectococcygeus, except in those rare instances in which the iliococcygeus does not show any layers at all.

The study of the retrorectal cell spaces and fasciae is considered to be very important, and we will add to it a study of the vases, nerves, lymph vessels and the coccygeus glomus of Luschka.

Fasciae Diversely described by the authors, they have been the object of our specia! attention in six pelvies which we expressly dissected for this purpose. The parietal pelvic fascia covers the pyramidal, the ischio-coccygeus, the rectococcygeus, the levator ani, and the internal obturator muscles, and extends itself before the sacral bone, forming the presacral fascia, a dependency of the external stratum of Tobin-Benjamin-Wells. In its presacral portion this fascia displays the following characteristics: First, it is attached to the bone by the means of slack tissue which is easily detached except on the first sacral part, at the level of which it strongly adheres to the periotenum; second, it is very hard to detach at the level of the sacral holes, as the nerves which is contains form a strong boundary; third, downwards, and corresponding to the last sacral bone it is strongly attached to it and at this level it grows thicker, forming the fascia of Waldeyer; fourth caudally, it

merges into the sheath of the rectum, or inner stratum of Tobin. The intermediate stratum does not appear at this portion, and it is considered to be divided into two layers, the outer one forming the rectal fascia, and the inner one forming the anal capsule, appearing upon the rectococcygeus of Treitz and sharing the distribution of this muscle in the anal canal; fifth, cranially, it is considered as the termination of the aortic-abdominal layer. Embryologically, it would be the end portion of the fascia transversalis, or external stratum of Tobin. The aorta, the cava, and the urogenital system are in the intermediate fascia, following laterally by the ureters. At this medium part in the adult, though, it seems as it is were continued by the sheath of the great vessels, and the medium sacral muscle runs through the external stratum and follows its way between fascia and bone; sixth, laterally, at the level of the anterior sacral holes, it is crossed by the sacral sympathetic nerves with a conjunctive felt-like lining, and at that point it is united to the wing which covers the lateral sacral arteries which come from the root of the hypogastric sheath, and which is continued anteriorly by the presacral wing of the hypogastric sheath. Therefore, only the portion of the presacral fascia which is between the sacral holes takes part in the formation of the posterior wall of the retrorectal space, which explains the statement of Paître and others.

Rectal Fasciae The superior hemorrhoidal artery is found in the midst of a conjunctive-fatty magma, which can be separated from the bone plane, and, as can be observed, is covered by a smooth tela which fixes the vases to the rectal wall. Uhlenhuth thinks that from the root of the hypogastric sheath which he calls presacral wing of the hypogastric sheath (not to be confused with the presacral fascia) which is continued with the sheath of the superior hemorrhoidal vessels which upon arriving at the rectum unfolds itself on the anterior and posterior layers forming the rectal fasciae. This layer corresponds to the internal stratum of Tobin, and in it we find the presacral nerve, sometimes with several edges, always predominantly to the left side, and the hypogastric bundles which will form the hypogastric plexus. Laterally the ureters can be seen, posteriorly with respect to the hemorrhoidal vessels, as they belong in the intermediate layer of Tobin.

Retrorectal Space This space is diversely described by various authors. Some of them, as competent as Paître and his colleagues, state in their "Pratique Anatomo-Chirurgicale Illustrée," page 384: "Il est limité en arrière par la partie du sacrum comprise entre les deux lignes de trous sacrés, en avant par la paroi postérieure de la gaine, et de chaque côté par les lames sacro-recto-génitales," and on page 542, referred to in the same page, he limits it from behind by the sacrococcyx continued by the ischiococcygeus.

In a horizonal section of the pelvis through the second sacral bone, we can separate the rectum and its fascia to front, remaining at the back of the pelvic fascia or presacral fascia. Separation is easy to except at the portion where the sympathetic and parasympathetic bundles stem, those at the level of the anterior sacral holes from walls with thick conjunctive tractus which besides carry branches of the lateral sacral artery. They are more resistant at their lower portion until the reach the coccyx, forming a sole wall of from 1 to 1.5 cm.

Figure 1. Horizontal section of pelvis through the sacro-coccyx. 1. Anal fossa. 2. Caudal intestine. 3. Anterior medial section, for a better view. 4. Relief of the ano-rectal muscular ring.

thick. These branches go to the rectum and to the hypogastric plexus, and correspond to the posterior portion of the sacro-rectalgenito-pubial fascia which runs from the sacrum to the pubis like parallel bars. At the coccyx the pelvic fascia adheres strongly to the rectum (Fig. 2) and it seems to us that this is what makes the fascia of Waldeyer so firmly attached to the bone plane. The roots of the parasympathetic nerve stem from the sacral roots and principally the erigentes nerve (2nd S. to 4th S.).

Fixation of the coccyx to the rectum is quite strong, there are contained in it the rectal branches of the medium sacral artery, as well as branches of the coccygeus nerves and lympathics, forming a real ilio of the caudal intestine. Due to the fact that this thick and resistant conjunctive tissue intertwined with smooth muscular fibers, occupies the medium sagital plane and ties up the rectum, fixing it to the coccyx, and due to the fact that it lies upon the so-called anococcygenus raphe, it could well be considered as a rectococcygeus raphe.

The retrorectal space is thus partitioned, showing two lateral pouches and one medium pouch, these being placed between the aponeurosis (fascia) of Delbet, which get closer to each other at the lower end in half-open book fashion (Delbet); the lateral ones are more clearly separated principally at their lower portion, as can be confirmed by inserting a finger in each one. Being the retrorectal abscesses generally filled with a great amount of pus, they are, according to Bacon " . . . inducted

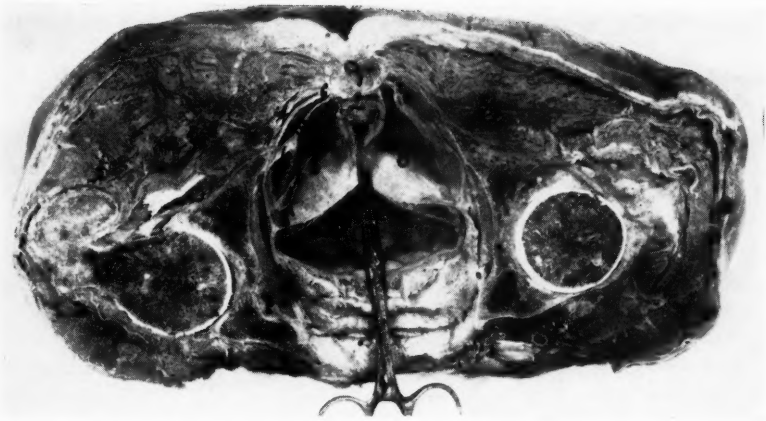
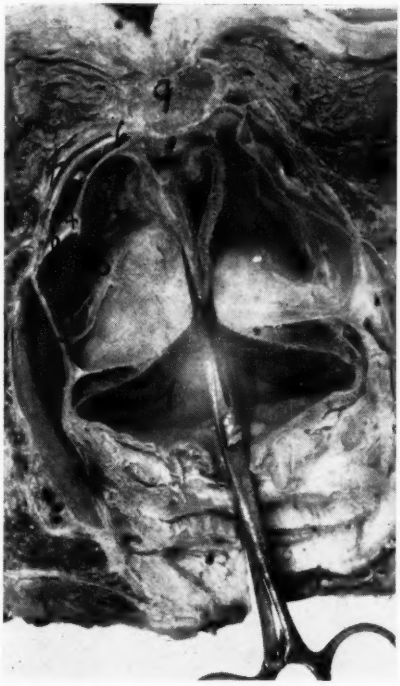


Figure 2. (above and below) 1. Rectum, its posterior wall is held with forceps and is tractioned to show the recto coccygeus raphe. 2-3. Presacral hypogastric wing which in 3 forms the rectal fasciae. 4. Hypogastric vases. 5. Wing of the lateral sacral arteries. 6. Fascia of Waldeyer. 7. Ischiococcygeus muscle. 8. Retrorectal space. 9. Coccyx.



fluctuating mass posteriorly and outside the wall," and the incision should be " . . . an anteroposterior incision . . . lateral and slightly behind the posterior anal verge."

Cranially the retrorectal space is larger than the rectum as it goes up to the first sacral and continues further on with the prevertebral space, it follows the great vases and the root of the sigmoid mesocolon. Caudally, there is the fascia of Waldeyer which rests on the rectococcygeus muscle. This fascia, which is strongly fixed to the coccyx, does not permit the descent of the rectum until it has been incised transversally (Gabriel), but as it is crossed through by vascular and nervous elements, it explains the tendency of retrorectal abscesses to open up between the coccyx and the anus, the Pott abscesses may "fuser" from the prevertebral to the retrorectal spaces and to the ischiorectal fossa. Laterally, we find the following layout: in front of the sacroiliac articulation and at the level of the major sacro-sciatic opening, there is the root of the sheath of the hypogastric vessels

which rests upon the weak fascia of the pyramidal nerve originating in the anterior face of the sacral nerve, and which comes out of the pelvis through the larger sciatic opening, covering its fascia also the bundles of the plexo-sacral nerve which are on the muscle. At the hypogastric root we find the internal iliac artery and its original branches. The superior and inferior lateral sacral arteries run towards the sacral holes taking along with them conjunctive tissue, and having the aspect of a layer which goes from the root of the hypogastric muscle to the anterior sacral holes. Besides, it is from that point that the sacral nervous bundles stem running towards the rectum and walling the retrorectal space. From the root of the hypogastric sheath another conjunctive wall originates, forming the rectal fasciae, which is continued with the sheath of the superior hemorrhoidal vessels, that is, the presacral wing of the hypogastric sheath.

When a finger is inserted within the retrorectal space, it is laterally stopped by the root of the hypogastric sheath, behind which there is the wing of the lateral sacral vases, and in front of which there is the presacral wing.

Within the retrorectal space there is soft tissue which permits easy sliding of the rectal ampulla when it expands in the defecating act.

Glands of Luschka This formation which is so diversely named, is found at the end of the medial sacral artery, which should be followed like Ariadna's thread in order to locate it. It is attached to the last coccygeus vertebrae or node, being in direct contact with the bone, and fixed there by the levator ani bundles at their coccygeus insertion. The medial sacral artery follows the caudal extreme of the coccyx and terminates at its distal extreme. The gland proper, a small node of 3 mm., is found in a fatty atmosphere within its small cell, and is sometimes diffuse. A delicate dissection shows small filaments which attaches the gland to the walls of its small lodge. It is considered to be a glomus, and like other glomus, it is

Figure 3. The anterior edge of the anal fossa is elongated on the anterior face of the rectal ampulla which forms a pouch brought forward by the recto-urethral muscle . The posterior edge forms a right angle with the post-anal intestine. In the living this edge forms a more noticeable border because of the ano-rectal muscular ring.

formed by a group of cells which are separated from each other by delicate partitions, presenting the aspect of an internal gland. It is partly constituted by a vascular lacis, stemming from the medial sacral artery, and nervous fibers of the coccygeal sympathetic nerve.

Poirier discards the theory of its originating either in the intestine, the caudal spine or medulla, as well as its ectodermic origin, and states that only two possibilities remain: it is either originated from the pelvic sympathetic nerve (Luschka), or else from the caudal vessels (Gegenbaur). We suggest that it may be originated from both formations giving place to a glomus.

Pi Suñer states that this glomus like all other glomuous tissue in general belongs in the category of chromaffin-paraganglionar tissue, even though its cells do not contain adrenalin. Its stimuli would be mechanical and chemical ones. Alike other economy glomus (carotid and aortic glomus) it is related to a hollow organ which is subject to pressure changes. Luschka places emphasis upon the abundance of Vater corpuscles.

Pi Suñer considers it as a point of the economy where endocrine secretions are related with the nervous system, neuroendocrine synergy.

It has been demonstrated that hyperpressure of the glomus causes secretory inhibition of adrenalin and vasodilation, and vice-versa. When there is an increase of pressure in the storage chamber (with urgent need of emptying the intestine and resistance on the part of the person), the hemorrhoidal plexus is ingurgitated and helps to close hermetically the anal canal. Hyperpressure of the glomus may be caused by: 1) increase of pressure of the rectal chamber; 2) by muscular contraction; 3) by increase of the venous pressure when the pressure of the rectal chamber increases when the muscles are contracted, and 4) when the coccyx is distended owing to pressure exerted by the anterior sacrococcygeous ligaments.

These conclusions are hypothetical ones suggested by the regional anatomy and by the physiology of other glomus. There is the possibility of these enigmatic bodies having a complex physiology related to the act of defecation.

These glomus are explored by rectal finger inspection, and the tip of the index finger must find them at the end of the coccyx. In normal cases it is not possible to locate them by palpation, but they are easily noticed in the morbid processes.

Blood Supply The caudal intestine is supplied by the medial sacral artery, an embryonic prolongation of the aorta. It stems from the posterior face of the aortic bifurcation up to the fifth lumbar vertebra and follows the bone layout, being supported by the parietal pelvic fascia, running below the sacrococcygeous ligaments up to the tip of the coccyx where it ends in the gland of Luschka. This is the artery proper of the caudal intestine. Quenu calls attention to three collateral branches, two of which stem at the level of the last two sacral holes, and the other one running under the basis of the coccyx.

The sacral medial veins start at the glomus of Luschka and generally run in pairs, as collaterals of the artery, either double or forming an only trunk, they run into the primitive left iliac vein, seldom into the right one.

The medial sacral vases are those proper of the caudal intestine and they supply its muscular layer, and are contained in the recto coccygeus raphe,

Figure 4. Lateral rectogram, man, in rest.

Figure 5. Same, in defecating effort. Note the extension of the coccyx and the sloped plane of the caudal intestine.

Figure 6. Same, with marked contraction of the sphincter, without abdominal effort. Note the flexion of the coccyx, and in the inferior face, the waves caused by muscular contraction.

which is a real ileum. Within the mucous membrane we find the network of the superior hemorrhoidal vessels, branches of the dorsal artery of the rectum, azygos of the rectum (French authors), or of the right posterior secondary trunk (English authors).

Lymphatic Supply The lymphatics follow the rectococcygeus raphe and run into the ganglions of the promontory, another reason to explain the grave prognosis of cancer at this portion, as these ganglions are closely related to the large iliac vases as well as with the bone, which makes exeresis difficult.

Nerve Supply The sacral sympathetic nerve is applied to the bone by the pre-sacral fascia, as well as the sacral roots. From both formations the

Figure 7. Posterior face, markedly convex, superior part of the parietal fixed bone relation. Inferior part of the parietal mobile osteo (coccyx) muscular relation, approximately horizontal, slightly descending towards the front. Both parts are continued without clear limitations.

Figure 8. The two portions of the posterior face form an angle approximately right. The inferior portion, which is almost horizontal, which is concave in the lower part, is the floor of the storage chamber, post-anal intestine.

branches stem, the first of which are in the Delbert layers, and the others pierce the retrorectal space, like more or less isolated threads, ensheathed in conjunctive tissue. The coccygeus plexus which ends as an anterior handle of the coccyx, gives out fibers surrounded by a felt-like tissue where vessels are also found.

Physiological Outline Having the caudal intestine in anatomy of its own, as well as blood, lymphatic and nerve supply of its own, and being related to a glomus, it must also have its own physiology.

Since O'Beirne, in 1833, it is admitted that normally the rectum is empty, until it is suddenly filled giving place to the call of nature and immediate defecation. Proctologists and gynecologists report that commonly the rectum contains feces even without defecation feeling. People generally defecate at a given hour, just as if it were a conditioned reflex. Sometimes, due to a mass movement of Holznecht, the rectum is filled or becomes completely filled, the intrarectal pressure increases suddenly, this being the physiological stimulus (40 mm. of Hg., which can go up to 200 mm. of Hg.). By the means of endoscopy, the rectosigmoid is often seen with the aspect of a tench nose, and even though we do not consider it

a piston for the purpose of filling the rectum, we believe it increases intrarectal pressure, principally when its contents are pasty, liquid or gaseous.

Defecation is normally a voluntary act, being an important point the increase of the interabdominal pressure. Rushmer has demonstrated that intrarectal pressure is approximately the same as abdominal pressure, being of no account the pressure of the rectal wall. Nevertheless, in cases of striated paralysis, defecation is effected, according to Denny-Brown and Robertson, through a local reflex, the intestine is contracted and the internal sphincter relaxes (automatic defecation).

Increase of the abdominal pressure gives a convex form to the perineum (the only wall which protrudes in the effort). When radiographic plates are confronted, a descent of the colon and the rectum is evident, and the latter one decreases its antero-posterior diameter, the transversal diameter increases showing increase and descent of the rectal contents. If the patient permits defecation, a slope towards the anus is formed in the caudal intestine, with a movement of the retrorectal within its cellular space. This is caused by the distention of the coccyx, the ileococcyygeus muscle contracts, the right angle formed by the ischio-coccygeous muscle becomes an obtruse angle, forming a canal between both ilio-coccygeous muscles, which can be observed if the patient is ordered to make an effort to defecate while the tip of the index finger palpates the coccyx and its sides. The myographs of Berglas and Robin show this sloped plane of the post-anal levator.*

Extension of the caudal appendix is universal. In the vertebrates having a tail, whose rectum is straight, it is extended by muscular action (caudal extensors); in the caudated orthogrades, the extensors are strophied, the function is performed by increase of the abdominal pressure.

At the same time, the anal canal opens by a mechanism which has already been discussed in another work, and which goes beyond the limits of this one. As a consequence, the feces which were in the storage chamber (storage space, Fanster) pass on to the emptying chamber, and defecation takes place.

The valves of Houston divide the fecal column in fragments, and they are so arranged as to direct it towards the storage chamber. They therefore form secondary storage chambers. There is no reason for the existence of these constant anatomical formations in a permanently empty rectum, and it is even funny to suppose that they serve the purpose of giving the fecal bolus a rotation effect in order to eject it as a ballistic missile.

Summing up, the caudal intestine represents the principal portion of the storage chamber of the rectum, it has a motor system formed by the second piece of the coccyx which is put into action by abdominal pressure and by the ilio coccygeus muscles which being contracted, form a sloped canal towards the emptying chamber, where the anal canal is. There are other muscles, flexors of the coccyx, which take part in the retention of feces.

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* With gold electrodes of 11 mm. insulated except 2 mm. at the tip, nailed to the sides of the coccyx, and connected to an electrocardiograph unit, we have obtained curves of the contraction of the ilio coccygeus muscle during the defecatory effort. This experiment is a difficult one as anesthesia is not practicable, and the depth of the caudal intestine presents great inconvenience. These experiments, though, should be repeated.

Clinical Considerations The post-anal intestine is generally explored by finger palpation. "The juncture of the posterior walls of the rectum and anal canal forms at least a right angle, and frequently an acute angle. In this manner, a definite posterior anorectal shelf is produced." (Nesselrod). Sometimes, the index is inserted into a veritable double bottom.

Endoscopy is very difficult. The Rectoscopy Atlas of Bensuade, 1956, plate 39, shows how it is possible for a large pathological formation to be inadvertently passed over. Indirect inspection is done with the aid of anuscopy of large gauge, and with the help of a small mirror such as those used in posterior rhinoscopy, with a 90° tilt. For direct inspection, a rectoscopy provided with distal light should be used, with the patient in position, and frankly tilting the tube upwards. These are the procedures for obtaining biopsy samples, they are not routine procedures, and clinically the physician must get along with intra-rectal palpation.

Radiological Considerations The accompanying plates of lateral rectograms are self-explanatory.

Pathological Considerations A thorough pathological study would be too extensive for the purpose of this work. Hernias have been observed in the posterior wall of the rectum following coccygectomies. When the condition is an advanced one, the anterior wall is also involved, which does not normally happen with the anterior rectocells which are antero-rectocells. This is due to the raphe, to the rectococcygeus muscle and to the fascia of Waldeyer. We are referring to the suppurated retrorectal inflammatory or plastic surgery processes (Nicolas and Favre).

Cancer of the rectum spreads up to the ganglions of the promontory, the vicinity of which to the large vases darkens prognosis.

Therapeutical Considerations For the treatment of rectal prolapse, this is one of the points selected for the fixation of the mucous membrane. Alfred Cantor, in his *Ambulatory Proctology*, plate 151, clearly demonstrates this step of sclerosing injection.

Summary

The caudal or post-anal intestine of the embryo constitutes in the adult the inferior part of the posterior wall of the rectum. It forms a pouch which corresponds to the coccyx and the ano-coccygeus raphe. It presents very special characteristics which point out the need of considering it as an anatomical, physiological and pathological unit, which deserves the particular attention of the proctologist.
Lucerna Street, Nueva Helvecia Colonia

Resumen

El intestino caudal o post-anal del embrion constituye en el adulto la parte inferior de la pared posterior del recto. Forma una bolsa que corresponde al coccix y al rafé ano-coccigeo. Presenta caracteristicas especiales que indican la necesidad de considerar su unidad anatómica, fisiológica y patológica, ameritando la atención especial del proctólogo.

WILLIAM LIEBERMAN, M.D.*
Brooklyn, New York

A Binocular Sigmoidoscope

The need has been felt for some means of observing and guiding the proctologic student or neophyte in the performance of sigmoidoscopy. The danger of perforation of the sigmoid by inexperienced insertion is very real; cases of perforation have been reported.

The binocular eyepiece† here described can be attached to the head of the sigmoidoscope, giving the instructor an opportunity to direct the student, as well as to indicate normal and pathological findings along the way.

When not in use for teaching purposes, the eyepiece can be used by a single operator for binocular vision by altering the length of the sliding arm.

The light beam is partially transmitted and partially reflected by the prism *abcd*. (See illustrations). The transmitted rays go to one observer *(A)*; the reflected rays strike prism *efg* (or a mirror at *ef*) and are reflected to the eye of the second observer, *(B)*.

This method permits observation only, not instrumentation, through the scope. A full normal view of the field is obtained.

Magnification may be secured by the addition of lenses at the eye-pieces. An adequately bright source of light is necessary, whether distal or proximal.

Summary

1. A method is described for simultaneous observation through a sigmoidoscope by two operators.

2. This is useful for the safer teaching of sigmoidoscopy and for demonstration of pathology.

3. Binocular vision can be obtained when used by a single operator.

198 Linden Boulevard

Resumen

1. Se describe un metodo para que dos operadores hagan observacion simultanea a traves del sigmoidoscopio.

2. Este es un sistema util para enseñar con mayor seguridad la sigmoidoscopia y para hacer demostraciones de patologia.

3. Cuando un solo operador usa el aparato puede tener vision binocular.

* Attending Proctologist, Department of Surgery, The Unity Hospital, Brooklyn, New York.

† This instrument is manufactured by Metro-Tec Scope Makers, 154 East Erie Street, Chicago, Illinois.

For Teaching Purposes

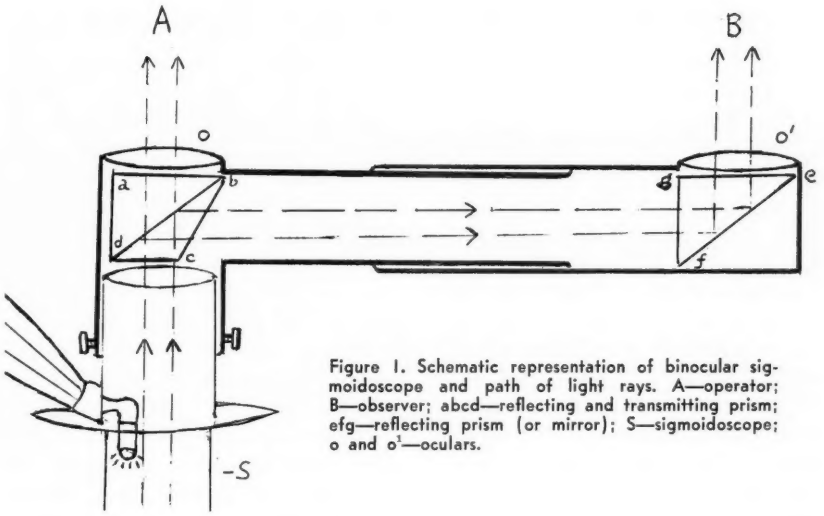


Figure 1. Schematic representation of binocular sigmoidoscope and path of light rays. A—operator; B—observer; abcd—reflecting and transmitting prism; efg—reflecting prism (or mirror); S—sigmoidoscope; o and o^1—oculars.

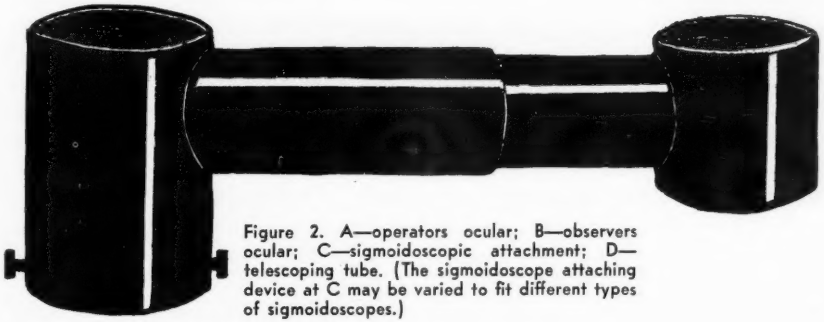


Figure 2. A—operators ocular; B—observers ocular; C—sigmoidoscopic attachment; D—telescoping tube. (The sigmoidoscope attaching device at C may be varied to fit different types of sigmoidoscopes.)

Sphincter-Saving Operations In the Treatment of Carcinoma of the Rectum

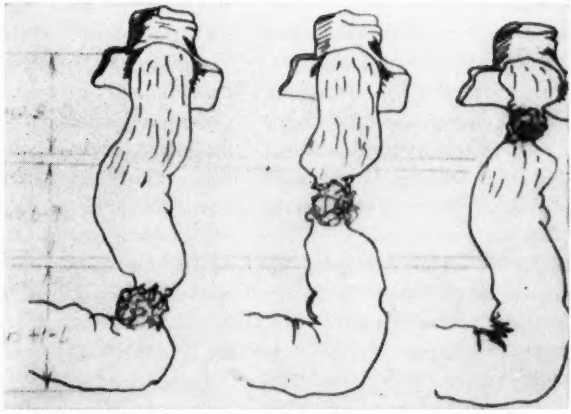
LOWELL R. SMITH, M.D.
El Cajon, California

CHARLES M. GARRETT, M.D.
La Mesa, California

A few brief years ago those who dared to talk in support of sphincter-saving operations for malignant lesions of the rectum were strongly criticized and those who did the procedure did so with no support of published past experience by the most eminent rectal surgeons. The established dictum was that the procedure to be performed at the levels of 6 to 14 cm. as well as those from the anus up to 6 cm. was combined abdominoperineal resection. This was the operation of choice and with statistical justification in the absence of reliable proof that here was a place for sphincter-preserving operations for growths in this area. New evidence, however, indicates that these concepts should be re-examined to determine which type of operation offers the best overall result, both from the standpoint of cure and from the standpoint of physiological function in the individual case of carcinoma located within these limits.

Extirpation of the rectum with preservation of the anal sphincter is not a new approach. Prior to 1900, several European surgeons[5] had performed operations designed both to eradicate the disease and to leave the patient with normal sphincter function. Most of these were performed entirely through the perineal route and thus met with a high incidence of recurrence.

(Slide 1) For the sake of discussion, the lesions may be divided into those from 0 to 5 cm., from 6 to 9 cm., and from 10 to 14 cm. measured through the sigmoidoscope from the pectinate line to the most distal portion of the lesion. Of course, the accepted operation of choice for malignant lesions which lie below the 6 cm. level is the one-stage combined abdominoperineal resection and it is only as a rare ex-



Slide I

ception that anterior resection or other type of sphincter-saving operation should be attempted with view to cure for lesions thus situated. For example, in Dr. C. W. Mayo's series of 1104 cases, it was employed only three times.[6, 7] The belief that malignant lesions in the last 5 cm. of the rectum have the poorest prognosis is widespread, but findings in Dr. Mayo's series did not support that. In 254 cases in which one-stage combined abdominoperineal resection was peformed, 50.4% of the patients survived five years or longer, regardless of the presence or absence of metastasis at the time of operation and this rate did not vary significantly from among the cases in which lesions were situated 6 to 9, or 10 to 14 cm. from the anal margin.

Lesions situated 10 to 14 cm. from the dentate margin of the anus are dealt with almost 100% by anterior resection and the five year survival rate in Dr. Mayo's series of cases was 61.3% compared with a five year survival rate of 48% in the combined abdominoperineal operation for the lesions in the same area.

This leaves for our discussion the lesions 6 to 9 cm. from the anal margin. These are the cases that in the past have caused the most controversy as to the advisability of some type of sphincter-saving procedure. Various recent studies have shown that the overall five year survival between the sphincter preserving operations and the abdominoperineal resections compares very favorably. Very little difference in the five year survival between the sphincter preservation and without sphincter preservation procedures has been noted. Dr. Mayo,[6, 7] comparing the low anterior resections with the combined abdominoperineal resections, in lesions 6 to 9 cm. from the anal margin, revealed 50.8% five year survival for the low anterior resection and 54.8% with the combined procedure. He states, "although there is a difference of 4% in favor of the one-stage combined abdominoperineal, what patient would not accept this risk to avoid permanent colostomy?" In a recent conversation

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Presented at the Tenth Annual Teaching Seminar in Mexico, April 1958.

with Dr. Mayo,[8] he mentioned that with further review of more cases this statistical difference has become even further narrowed between the two types of procedures. Dr. R. Best[2] believes that 75% of the patients with carcinoma between the 5 cm. and the 12 cm. level may have a sphincter-preserving operation and that the survival rates will be comparable to those with abdominoperineal resection. He also states that 75% of those having abdominoperineal resections do not maintain sexual potency. Summer and Maddock[11] feel that with increasing experience, the operation of resecting the mid-rectum with preservation of the sphincters will attain similar acceptance just as time has proven the anterior resection to be an adequate procedure for carcinoma of the sigmoid and upper rectum.

It is important to have a clear knowledge of the pathology and zones of spread of cancer of the rectum in selecting the proper operative treatment for cancer of the area. Beginning in the crypts of Liberkuhn and the rectal mucosa, carcinoma spreads by direct extension through the rectal wall and marginally along the mucosa. It has been shown that longitudinal spread is greater as one goes from mucosal to submucosal layers to muscle layers, arrangement being roughly triangular from within outward. It has often been demonstrated that longitudinal spread is seldom more than 2 cm. above or below the gross mucosal edge of the lesion. Quer, Dahlin, and Mayo[9] reported that of 89 patients with resectable tumor of the rectum or rectosigmoid, 88 would have been cured by removal of 2.5 to 3 cm. of intestinal wall below the primary lesion.

They recommend that such a lower cuff of bowel is sufficient to make the operation adequate. Guersney, Waugh, and Dockerty,[4] studying 210 cases, found 17 with involvement of the internal anal sphincters and in each the lower border of the primary lesion was within 3 cm. of the dentate line. It has thus been well established from pathological studies that as far as the actual bowel was concerned, there is no need for transections more than 4 to 5 cm. below the gross lesion, and this is the length which should be attained.

In stressing the lymphatic spread of carcinoma of the rectum, one must not lose sight of the venous spread, the latter being just as important. Involvement of the venous system is thought to begin in the tumorous intestinal wall and adjacent peri-rectal tissue, and it's occurrence varies directly with the degree of differentiation of the primary tumor. Blood vessel invasion does not always mean metastasis, however.

The type of operation certainly should depend on the operative surgeon and the results of this surgery depend on how thorough he is. Certainly a man who has not done the anterior resection or sphincter-saving type of operation for lesions from 6 to 9 cm. level and yet has had good success with the combined abdominoperineal procedure, should continue to do the proceure with which he is most skillful. Operations designed to eradicate cancer of the rectum with preservation of the sphincter should remove widely the tumor, the lymph-bearing tissues, followed by the bringing down of a tube of sigmoid, descending, or splenic flexure colon to anastomose with the sphincter mechanism or to the lower end of the bowel near the anus. In many hands, however, as we have seen, the survival rate is as good in pre-

serving the sphincter as with doing the combined procedure.

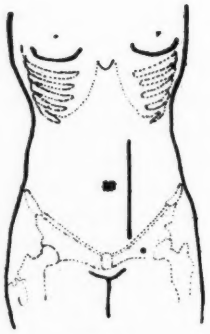
The pull-through operation has long been used by the Babcock and Bacon[1] for carcinoma of the rectum. In their operation, the abdominal phase is much like that of the Miles procedure, except that as done by others, they divide the superior hemorrhoidal or inferior mesenteric arteries depending upon the height of the lesion. Also, to obtain well vascularized colon, the descending splenic flexure and left half of the transverse colon are mobilized in order to bring bowel with a good blood supply through the perineum. Saver and Bacon stress the freeing of the rectum by separating it with the endo-pelvic fascia from the pelvic walls. The perineal phase of the operation is carried out by a midline incision passing through the posterior border of the anus, the perineum, and up over the coccyx. The rectum is divided at the anal junction and dissected free as it is withdrawn. It is divided well above the malignancy and alowed to protrude 10 cm. through the anal sphincters, which are closed around it as the perineal wound is closed. Eight days later, the bowel is amputated 2 cm. from the anus, to which it adheres in the process of healing. The five year survival for the Babcock and Bacon pull-through operation is reported at 79% which is exceptionally high, well above the 50% average from most sources for the Miles operation. M. Black's[3] technique for the sphincter-saving operation is not too unlike that of Bacon.

The operation reported by Waugh[12] is briefly as follows: The abdominal phase is conducted much as the Miles procedure. A site at the upper sigmoid with a good blood supply is selected and cleared of fat before the perineal portion. For the latter, two types of operations are mainly done; first the most commonly used, works through the external anal sphincters, dissecting the anal canal from both the superficial and deep muscle bundles and working upward severing the attachment of the levators circumferentially and progressing anteriorly between the rectum and prostate or vagina until the abdominal phase is encountered. The rectum and sigmoid with surrounding structures are then brought out through the sphincter orifice and cut across an inch beyond the peri-anal skin. Waugh's second procedure is a modification of Babcock and Bacon's perineal dissection; the sigmoid being brought through a posterior split external sphincter or through an intact external and internal sphincter. Of 45 such cases operated upon five or more years previously, 51.5% survived five years, a figure which stands up well with the 49.6% five year survival in his series of 275 patients with lesions located 10 cm, or less from the anal margin and operated upon with a classic abdominoperineal technique.

As for sphincter function in Waugh's[12] series, 10.3% were excellent, (bowel control was as normal as before the operation), 42.3% good, (able to control non-diarrheal stools and wear no perineal pad), 24.8% fair, (perineal pad necessary because of occasional soiling and frequent rectal irrigations to maintain continence), 22.6% poor, (virtually incontent). It is emphasized that frequent dilatation of a stenosis occurring just inside the perineal outlet aids development of continence following this operation.

Summer's and Maddock's[10] selected procedure is much the same as that of

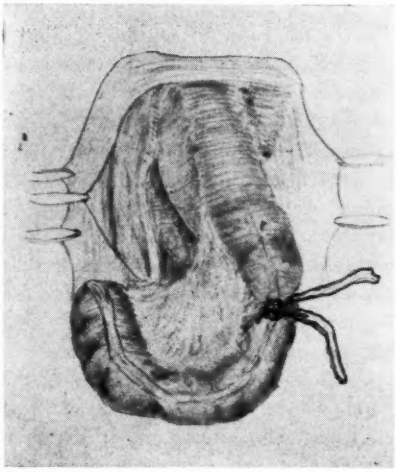
Best[5]; the abdominal part being similar to those techniques just discussed. A right upper quadrant, temporary transverse colostomy is constructed to protect the colorectal anastomosis for from three to six weeks. The perineal part of the operation is carried out in a Buie or a left lateral Sims position, begins with a mid-line perineal incision from the posterior edge of the external sphincter, upward over the coccyx. The latter is removed and a transverse incision though the coccyx bed gives entrance to the pelvic area freed during the abdominal part of the operation. The finger is swept above each levator and this muscle is cut as closely as possible to the pelvic wall. The sigmoid and rectum are then brought out of the wound and the lower rectum dissected from the seminal vesicles and prostate or vagina anteriorly. The uppermost sigmoid or descending is transected well above the site of the inferior mesenteric ligation and the presence of good bleeding is ascertained. The rectum is cut across 4 to 5 cm. below the gross edge of the tumor. The upper colon segment and the rectum are then each irrigated with distilled water to wash out the free tumor cells likely to be lying on the mucosa. A two layer anastomosis is then made between the upper colon segment and the small lower rectal cuff, using fine continuous catgut for the mucosa and the finest wire for the muscular coats. Epiploic appendages are sutured over the anastomosis site and to the pelvic wall to fix the colon in the pelvis. For several days post-operatively, the sphincters are kept open by a five inch segment of the largest mushroom catheter. Turnbull[11] prefers a similar procedure utilizing a Swensen modification operation in which he pulls the



Slide 2

colon through the external sphincter everting the lower 3 or 4 cm. of mucosa, making the anastomosis on the outside and then replacing it back into the pelvis. He makes a strong point in favor of this procedure in that the patient is less apt to have incontinence and has the urge to defecate because of the nerve endings found in the last 2 to 3 cm. of the rectal mucosa. Turnbull also favors resecting the entire sigmoid, freeing the splenic flexture and bringing the descending colon down for attachment to the lower end of the rectal mucosa.

The authors prefer the low anterior resection and anastomosis in the treatment of these lesions in the 6 to 9 or 10 cm. level. They use a modification of the procedure described by Dr. C. W. Mayo.[7] The factors that greatly influence the feasibility of this procedure are of course, the adequacy of the pelvis, the amount of adipose tissue, and the persistance and dexterity of the operative surgeon. In our hands, this has proven the best procedure and equally effective as the combined abdominoperineal resection. An essential part of this operation is instruments of proper length and shape to enable one to work



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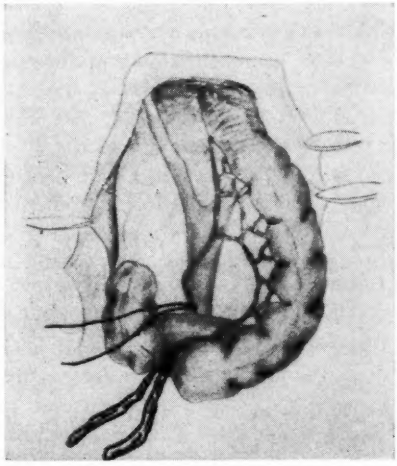


Slide 4

Slide 5

Slide 6

in the deep regions of the pelvis.

A left rectus muscle-splitting incision is made extending from the pubis below to the rib margin above. (Slide 2) The self-retaining retractors are placed and the small bowel is packed away. The lesion is not examined, handled or squeezed with the hand. (Slide 2) The peritoneum in the left gutter is first incised and the sigmoid and descending colon in the upper sigmoid at a level well above the lesion and tied stightly to prevent any spread of cancer cells upward. (Slide 3) The descending colon and sigmoid are then reflected medially across the mid-line, the retroperitoneal duodenum is mobilized upward and the inferior mesenteric artery ligated close to its origin, and the vein at its junction with the inferior vena cava. Thus, we have isolated the lesion both from the standpoint of venous, lymphatic, and direct spread before proceding further with the procedure. The splenic flexure and the transverse colon are then mobilized so an adequate amount of bowel can be brought into the pelvis for anastomosis without tension. The abdominal phase is then carried out similar to the Miles procedure taking widely all fatty areolar tissue and lymphatics along with the sigmoid and rectum en bloc. We dissect this down to a point at least 3 to 4 cm. below the lesion. (Slide 4) The rectum is clamped at this level and transected leaving a remaining cuff of rectal mucosa deep in the pelvis. This lower stump is thoroughly irrigated to remove any cancer cells that may be clinging to the mucosa. The entire mass is then transected at the level just above the original umbilical tape was tied around the sigmoid. It is important to see that the cut edge has a good blood supply and bleeds freely. In making the anastomosis, the essential points are: 1. It must be made without tension. 2. It must be made accurately. (Slide 5) The center posterior suture is placed first with a single cotton suture placed into the muscular coat of the cut edge of the rectal stump and then in the mesenteric side of the outer coat of the transected proximal barrel of the sigmoid. This suture is left long and is clamped. Three or four similar lone cotton sutures are placed on each side, spaced around the posterior 180° of the sigmoid and these are likewise left long and clamped. The long interrupted cotton sutures are placed in order over the hands of the surgeon and of the first assistant. The sutures are drawn moderately taut and with them serving as "guide ropes", the upper barrel of the bowel was worked gently down to a position at the posterior edge of the rectal stump by means of a gauze sponge stick. The interrupted cotton sutures are then tied, the two extreme lateral sutures and the center one are left long in order to aid the mucosa row of running fine catgut suture of double or triple #0. This catgut is about thirty-six inches long and is fixed on a needle. (Slide 6) The mucosa of the posterior half of the anastomosis is closed by running a through-and-through lock stitch and that of the anterior is a "baseball stitch", as described by Dr. C. W. Mayo, which catches the edge of the outer coat, runs along the submucosa, and catches the edges of the mucosa and then goes to the other side. The anterior outer coat is then closed with multiple interrupted cotton sutures. Many times where the pelvis is narrow and it is impossible to get this running suture in, the inner row of catgut suture is not used, leaving only a single row of interrupted

cotton around the entire circumference. One or two small Penrose rubber drains are left in the pelvis and brought out through stab wounds. The pelvis is peritonealized if easily done, otherwise not. It seems to make little difference one way or the other. No proximal colostomy or cecostomy is performed. A long tube, passing up through the anastomosis, may or may not be used as long as the anus is dilated immediately post-operatively so the patient will not retain gas or feces. It is most important that a finger or other object not be inserted into the rectum for many days, as the anastomosis is too easily separated.

We feel the advantages to this procedure are: 1. It can all be done from the abdominal approach and thus decreases the chance of contamination using the combination procedure. 2. It leaves an end of rectal stump with its nerve supply so that the patient has the urge to defecate and does not end up with a perineal colostomy.

Summary

It might be said that malignant lesions of the rectum in the 6 to 9 cm. level, can now be well treated with a low anterior resection or other type of sphincter-saving procedure with as good a survival rate as the old combined abdominoperineal operation as described by Miles.

In our hands, the low anterior anastomosis has proven to be the superior procedure, but any operation should be reserved to what the surgeon does best and with which he achieves most satisfactory results.

148 Rea Street
5107 Garfield Drive

Resumen

En resumen, puede decirse que lesiones malignas del recto al nivel de 6 a 9 cm. no se pueden trator adecuadamente con una reseccion anterior baja u otro procedimiento que preserve el esfincter entan buena posibilidad de preservar la vida del paciente como la viejo operacion combinada. abdominoperineal. descrita por Miles.

En nuestras manos, la anastomosis anterior baja ha probada se un procedimiento superior, pero cualquier operacion debe ser restringida a la que el cirujano hace mejor y con la qual obtiene los resultados mas satisfactorios.

EDITORIAL

The New York Teaching Seminar

The International Academy of Proctology is particularly proud of its Eleventh Annual Teaching Seminar, to be held in New York City at The Plaza, April 5-9th, 1959. All physicians are cordially invited to attend, whether or not they are affiliated with the International Academy of Proctology. As in the past—there is no registration fee.

The Academy is particularly proud of the emphasis on practical, everyday material that every physician can use in his own practice, regardless of his specialty. A particular feature at the Convention will be the symposium on the Psychosomatic Aspects of Intestinal Disorders. The principles of psychosomatic medicine, as they will be presented in the symposium may be applied with profit to every field of medical practice. The authoritative presentation—in non-Freudian Jargon—will be appreciated by the audience. The emphasis will be on practical therapeutic applications rather than on nebulous theory.

The full program will be carried in the April issue of the *Journal.* The Scientific Sessions, combined with the fabulous Annual Dinner Dance—in the usual Plaza style—the extensive social program planned for the ladies—and the natural glamour, theater and shopping world that makeup New York City—will make attendance at this Convention an absolute must.

There are not many room reservations remaining, and the limited block of rooms available should be placed in reserve without further delay. Please send your reservation card or letter direct to the Plaza at once, or we will be glad to arrange it through the Academy Executive Offices, 147-41 Sanford Avenue, Flushing 55, Long Island, New York.

Hypertrophy of the Pyloric Muscle

A review of the literature on hypertrophy of the pyloric muscle in the adult with relation to the frequent occurrence of pyloric stenosis

ADOLPH W. BRAZDA, M.D.
Ranger, Texas

Hypertrophic pyloric stenosis in adults is achieving increasing publicity as reports are trickling into literature.

Much has been written about the etiology and treatment of pyloric stenosis, with many theories advanced as to the etiological factors of the pathological condition that exists.

Credit for first recognizing hypertrophy of the pyloric muscle has been given to Fabricius Hildanus for his *Observanti Singularis de Obstructori Pylori* unearthed by Kellet. In 1675 Wolfgang Hefler, noting the above reference, wrote that it was so rare that he himself had never seen a case. Early reports were made by Blair in 1717, Weber in 1758 and Armstrong in 1771. In 1778 Hezekiah Beardsley reported hypertrophic pyloric stenosis, found at autopsy in a five year-old boy, to the New Haven Medical Society. In 1835 Jean Cruveilhier, reporting the case of a seventy-two year-old female who had vomited all her life, described hypertrophy of the pyloric muscle found at post-mortem examination. A typical case was reported by Williams in 1841. Simeon-Daworsky reported ten adult cases in 1842. In 1879 Landerer applied the term congenital pyloric stenosis to the condition. In 1885 Maier wrote of his findings in thirty-one cases in the adult studied at post-mortem. Hirschsprung wrote his classic description of the condition in 1888. One year earlier, he reported post-mortem findings in two cases before the German Pediatric Society. In 1893, Tilger reviewed the German, French and English literature and collected twenty-three cases, adding one of his own proved at post-mortem examination. Attention was first called to the palpable tumor by Finkelstein in 1896.

North and Johnson[15] were able to collect fifty-nine cases with operative or necropsy verification and added five previously unreported cases. In 1933 Judd and Thompson reported twenty proven cases.

John E. Connolly[3] likewise has reported in his review of literature, ninety-nine cases which were reported and treated by other contributors, from 1885 including 1949. It is necessary to recall the anatomy of the pylorus to understand better the localized pathologic entity.

Anatomy of the Circular Pyloric Muscle or Sphincter The circular muscle fibers of the stomach are not continuous directly with those of the duodenum. On the contrary, at the pylorus they become very much increased in number, and they form the sphincter, which is separated from the circular muscular coat of the duodenum by a fibrous septum. The sphincteric ring is thus sharply marked off from the duodenum, but there is no sharp line of demarcation on the gastric side, for it gradually merges into the circular muscular coat of the cylindrical pyloric canal. The longitudinal muscle, however is a variable muscle; about fifty percent of its fibers interdigitate with the circular muscle to form the dilator muscle, while a lesser percentage of the fibers continue into the duodenum. Thus, the pylorus is complete sphincter with both dilator and a constrictor muscle.

The gastric mucous membrane is continued into the mucous membrane of the duodenum at the distal margin of the sphincter. The gastric mucosa is considerably thickened where it covers the sphincter muscle.

The nerve supply is derived from the two vagus nerves and from the caeliac ganglia of the sympathetic. The vagi nerves pass through the diaphragm with the esophagus, the left lying on its anterior, the right on its posterior aspect: in this way they reach the anterior and posterior surfaces of the stomach respectively. Here they unite with the sympathetic fibers from the caeliacs plexus which pass to the stomach. The nerve fibers which are chiefly non-medullated, form two gangliated plexuses, those of the myenteric plexus and the submucous plexus, in the muscular and submucous coats respectively. We will be concerned only with the myenteric plexus in the subsequent report as we discuss the etiology.

Physiology of the Movements of the Sphincter Pylori During the first ten or fifteen minutes after the introduction of food the pyloric orifice is more or less tightly closed. After this period, it opens at irregular intervals to permit the passage of liquified food which is ejected by peristaltic waves for a distance of two or three centimeters into the duodenum. The frequency with which the pyloric orifice opens depends apparently on the degree to which the food is softened, and the vigor of the peristaltic contraction waves.

The factor which causes an inhibition of the sphincter from time to time as well as its subsequent contraction, has been a subject of experimentation and discussion.

From many experiments made by Cannon, the conclusion was drawn that the factor causing the relaxation of inhibition of the sphincter pylori is the presence of free acid on the gastric side of the pylorus; its subsequent contraction the presence of free acid on the duodenal side. With the neutralization of the acid in the duodenum, its influence on the sphincter muscle is weakened, in consequence the muscle contracts when it once again becomes susceptible to the inhibitor influence of the acid within the stomach. It is probably for this reason that carbohydrates, which do not absorb the acid, are discharged from the stomach early; that the proteins, which postpone the appearance of free acid, are retained longer and that fats, which check the secretion of gastric juice are discharged slowly. (Cannon)

It should be emphasized, however, that the relaxation and contraction of

the pyloric sphincter, due to the action of free acid on the gastric and duodenal sides, respectively, can take place independently of the central nervous system, and through the intermediation of a local reflex nerve mechanism, the myenteric plexus, in the walls of the pylorus.

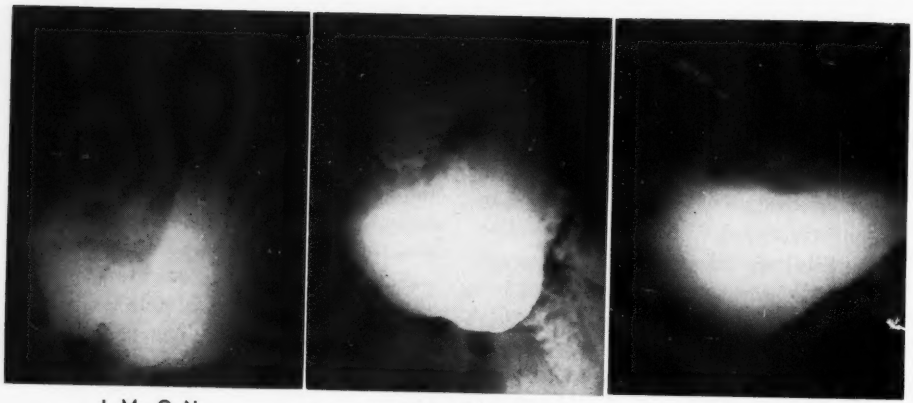
Etiology The etiology of hypertrophic pyloric sphincter has never been clearly understood. Several theories have been advanced by various investigators. Among these are those who believe in the theory of neurogenic imbalance which has been universally accepted. Then there are those investigators who consider the disease to be a persistence of a minimal congenital lesion which has been in existence for many years, and through some form of stimulus, has in the adult life caused this symptomology. It has been recognized by most investigators as well as the author of this paper, that the etiological factor is still an entity.

Lehmann in his investigations found that any neuromuscular imbalance caused work hypertrophy of the pylorus. Herbst in his investigations found evidence of disintegrating nucleoli and a loss of normal chromiti patterns in the myenteric ganglion cells of the pylorus in hypertrophic pyloric stenosis. Ingersoll[11] produced identical myenteric ganglion changes in the cells of the rat after prolonged vagal stimulation.

Doiel and Hill who make extensive studies histologically found a similar condition which exists in the ganglion cells in hypertrophic pyloric stenosis namely, only an occasional ganglion cell appeared normal and the great majority had undergone change. The nuclear membrane was indistinct and the nucleolus appeared to be separated into two or three segments or to have disintegrated entirely. Numerous ghost cells were found in all the sections of the pylorus in which the entire cell seemed to have lost its staining properties and merely appeared as a faint outline of a normal ganglion cell. These pathologic changes are similar to those seen by Ingersoll with excessive vagal stimulation and probably are due to exhaustion rather than the congenital defect in the ganglion cell. Over a long period of time with prolonged exhaustion the fibrosis increases, with the irregular pattern with the muscle fibers in all directions. The irregular pattern resembles the pattern of a leiomyoma.

In cases of hypertrophic pyloric stenosis the circular musculature of the pylorus was two to three times as thick as that of normal adults.

Incidence The incidence of Hypertrophy of the Pyloric Sphincter is much more prevalent than has been previously realized. The author agrees with Kleitsch,[12] who states that this condition is associated with sufficient constant roentgenographic features to be diagnosable by the radiologist or the gastroenterologist. An increased awareness and a closer study and observation of the history and examination of the individual with this disease, together with an appreciation of its diagnostic criteria, will bring surgical relief to a number of patients now treated medically for vague abdominal and epigastric symptoms. It is the opinion of McClure,[14] who has said: "We urge the greater need of its recognition in every case in which it is present, and its appropriate treatment by a sufficiently radical operative procedure. Palliation by medical treatment only postpones the day when operation is imperatively re-



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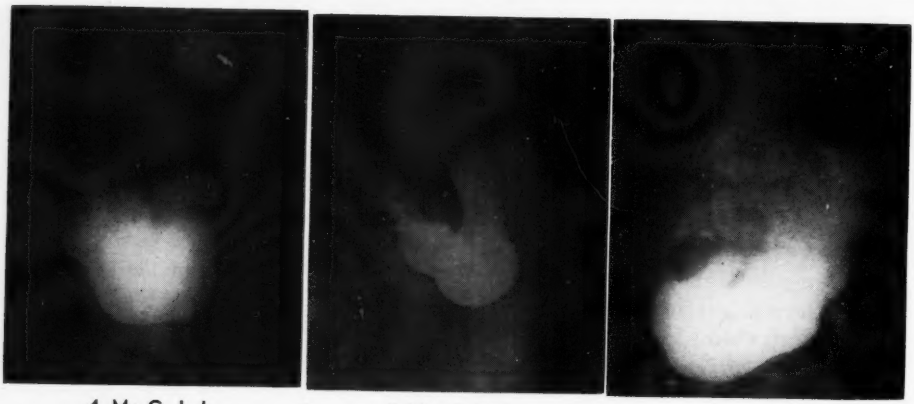

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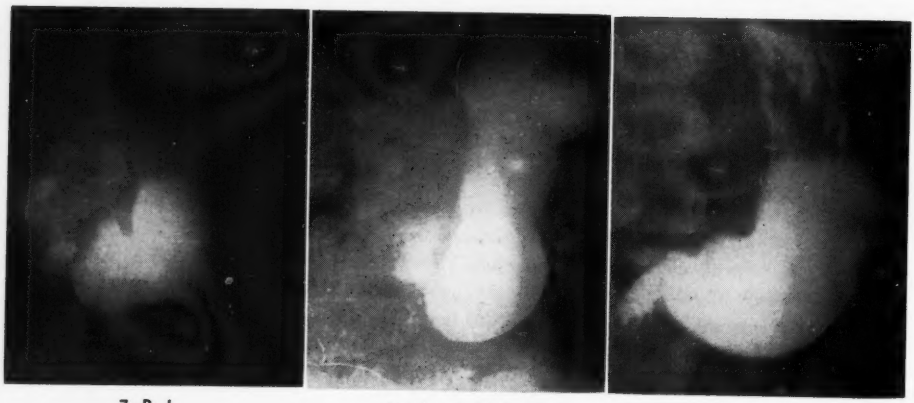


7. R. L. 8. Mrs. A. Z. S. 9. V. S.

quired and prolongs the patient's suffering."

Symptoms Pyloric hypertrophy in the adult can produce symptoms as a result of its own pathology or may produce symptoms together with associated or secondary pathology. In uncomplicated cases in adult pyloric hypertrophy the history is typical.

1. Epigastric pain is aggravated by ingestion of food.
2. Relieved by vomiting.
3. Night pains are notably absent.
4. A relatively high-grade pyloric obstruction may develop, manifested by the development of a postprandial epigastric mass which disappears after vomiting.
5. Symptoms do not respond to the use of antacids.
6. Belching after eating.
7. Only a few bites of food give a symptom of fullness and discomfort.
8. Limitation to small amounts of liquids.
9. Fear of pain when solid food is taken.
10. Loss of weight.
11. Weakness.
12. Nervousness.
13. Easily exerted.
14. Comfortable and at ease when the stomach is completely empty.

This type of history should lead one to suspect that some other condition exists than peptic ulcer or carcinoma which is producing these symptoms.

Roentgen Findings Roentgenograms of the upper gastrointestinal tract of patients with hypertrophy of the pyloric sphincter are absolutely characteristic and specific. The author has found in his series of cases which are demonstrated by the photographic plates in this paper, as did Kleitsch and his associates, that the roentgen appearance of the lesion to be typical, readily recognizable, and constant. In fact the typical picture is so definite and so constant that it is readily recognizable in roentgenograms published in studies of other observers on this subject.

The diagnostic picture is that of an elongated and narrowed pyloric canal, the thickened sphincter muscle giving the impression of a filling defect surrounding the pyloric antrum. For want of a better term, Kleitsch and his associates called the characteristic elongation and narrowing of the pyloric canal the "pyloric string sign." This sign is constant and is not obliterated by antispasmodics.

Treatment Since pyloric hypertrophy in the adult represents an organic obstruction to the passage of food through the gastrointestinal tract, it requires, as does congenital pyloric hypertrophy, surgical treatment which sometimes needs to be radical. No standard technique is recommended. Each procedure must be individualized to cope with the pathology which is discovered by the surgeon at operation. If the pyloric

The roentgenograms represent some of the cases from the author's series of authenticated cases. In most cases it was observed that there was a sac-like stomach, the most dependent portion of it extending about six cm. below the level of the iliac crest with the patient standing, the barium bulk tapering to a funnel-like configuration toward the constricted segment.

PATIENT	YEAR	AGE	SEX	MAJOR SYMPTOMS	DURATION	DIAGNOSIS ESTABLISHED	OPERATIVE TREATMENT	RESULT
1. C. N.	1957	26	M	Loss of wt. Pain Fullness	5 yrs.	Roentgeno-grams History	Bilroth I	Good
2. W. J.	1957	30	F	Vomiting Loss of wt.	5 yrs.	Roentgeno-grams History	Bilroth I	Good
3. J. F. S.	1957	50	F	Loss of wt. Gastric pain Fullness	8 yrs.	Roentgeno-grams History	Brazda Modi-fication of Heineke-Mikulicz	Good
4. C. J. J.	1957	60	M	Vomiting Gastric pain and fullness	6 yrs.	Roentgeno-grams History	Brazda Modi-fication of Heineke-Mikulicz	Good
5. J. O. S.	1957	64	F	Vomiting Loss of wt. Gastric pain and fullness	8 yrs.	Roentgeno-grams History	Brazda Modi-fication of Heineke-Mikulicz	Good
6. J. S.	1957	14	M	Vomiting Gastric pain and fullness Loss of wt.	5 yrs.	Roentgeno-grams History	Heineke-Mikulicz	Good
7. R. L.	1957	12	M	Pain in gastric region Distention Vomiting	3 yrs.	Roentgeno-grams History	Heineke-Mikulicz	Good
8. A. Z. S.	1956	64	F	Pain in gastric region Distention Vomiting Loss of wt.	3 yrs.	Roentgeno-grams History	Heineke-Mikulicz	Good
9. V. S.	1957	5	F	Loss of wt. Epigastric pain Vomiting after meals	5 yrs.	Rentgeno-grams History	Heineke-Mikulicz	Good
10. H. M. J.	1957	38	F	Pain Loss of wt. Fullness	3 yrs.	Roentgeno-grams History	Bilroth I	Good
11. B. R.	1953	30	M	Gastric pain and fullness	3 yrs.	Roentgeno-grams History	Heineke-Mikulicz	Good
12. A. L. T.	1956	71	F	Vomiting Pain and emaciation	6 yrs.	Roentgeno-grams History	Brazda Modi-fication of Heineke-Mikulicz	Good
13. H. L. B.	1957	39	F	Vomiting Fullness Gastric pain	4 yrs.	Roentgeno-grams History	Brazda Modi-fication of Heineke-Mikulicz	Good
14. E. H.	1957	73	F	Fullness Pain Loss of wt. Distention	5 yrs.	Roentgeno-grams History	Brazda Modi-fication of Heineke-Mikulicz	Expired 1 mo. Pulmonary Embolus

hypertrophy is the only pathology discovered, the operation should be the simplest procedure which will adequately relieve the obstruction. If only the pyloric hypertrophy is the pathological condition, then simple traction of the sphincter, carrying the incision well into the stomach and duodenum, with transverse closure of the resulting defect (the Heineke-Mikulicz pyloroplasty) has the advantage of simplicity and the least derangement of the normal physiology. When feasible, it is the preferred procedure. In patients where the muscular hypertrophy may have developed to a point where transverse closure might be awkward because of difficulty in inverting the thickened muscle, the most satisfactory procedure is the Bilroth I type of operation or some modification of it, by excising the sphincter muscle completely and restoring the normal continuity of the gastrointestinal tract.

Pathological The gross pathological findings seems almost constant. On palpation of the pylorus and observation, the serosal surface is smooth and no evidence of scarring. There is a firm indefinitely outlined mass that is palpable on the anterior wall of the pyloric region. The open surface presents a zone of thickening of the pylorus. The gastric membrane is not remarkable; the gastric wall is thickened. A cut section presents a gray glistening appearance.

Microscopic examination reveals an area of pyloric thickening, and the circular muscle layer is markedly increased in width, with fibrosis. Occasionally we found in our own specimens scattered inflammatory cells in the interstitial fibrous tissue. The mucosa which was attached to the excised specimen of sphincter muscle was infiltrated with lymphocytes, plasma cells, and some eosinophiles.

The author has devised an operative procedure which he has shown by his illustrations, the various steps to completion of the procedure, which is a modification of the Heineke-Mikulicz operation and which has the advantage of simplicity and least deranges the normal physiology and the myentric plexus, of the pylorus.

Details of the Operative Procedure A right mesial incision is made extending from the lower rib margin to the level of the umbilicus. The anterior sheath of the right rectus muscle is incised, the vessel of the inscription is clamped, ligated and incised. The rectus muscle is retracted laterally. The peritoneum is opened into the cavity, the liver edge of the right lobe is retracted upward, and the pylorus is lifted into the field of operation. The pyloric tumor is identified and grasped with the thumb and index finger of the left hand and held firmly (Figure 1). An incision about 3 cm. in length is made over the pyloric tumor extending proximally and distally to the tumor, through the serosa, to the anterior surface of the longitudinal muscle fibers and the connective tissue covering the circular fibers of the pyloric muscle, and the two edges are spread apart with small clamps exposing the layer of longitudinal muscle fibers (Figures 2 and 3). A longitudinal incision is made through the thin layer of muscle fibers over the hypertrophied circular muscle and extending proximally and distally to the hypertrophied muscle (Figure 4). It is retracted superiorly and inferiorly, thus exposing the fibrous circular muscle, allowing the mucosa to protrude into the incision proximally and distally

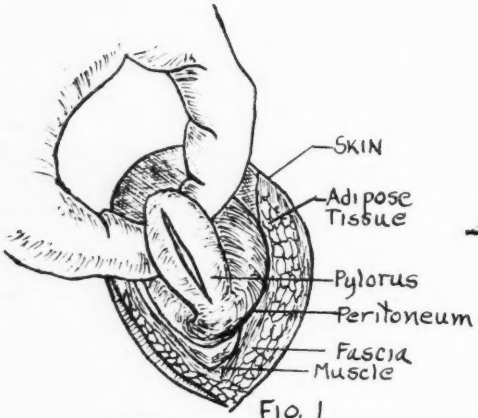
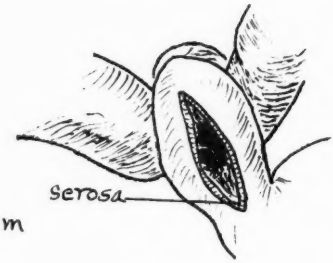


Fig. 1



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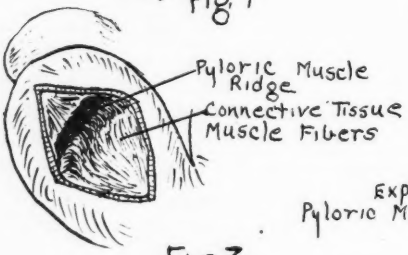

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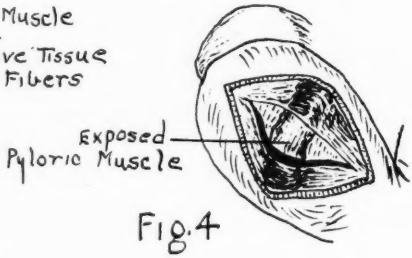

Fig. 4

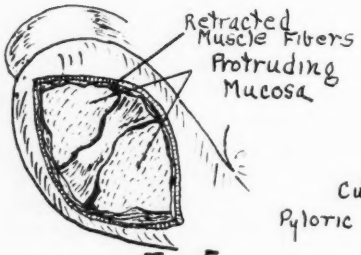

Fig. 5

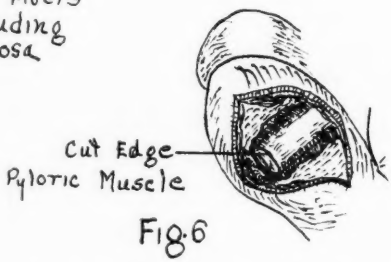

Fig. 6

Figure 1. Pylorus brought into field of operation with incision through serosa. Figures 2. and 3. Serosa spread, exposing the pyloric ridge and muscle fibers. Figure 4. A longitudinal incision is made through the muscle fibers to expose the pyloric muscle. Figure 5. Exposure of the anterior portion of the pyloric muscle, and protrusion of the mucosa. Figure 6. The beginning of the removal of a portion of the pyloric muscle by severing it at its inferior border.

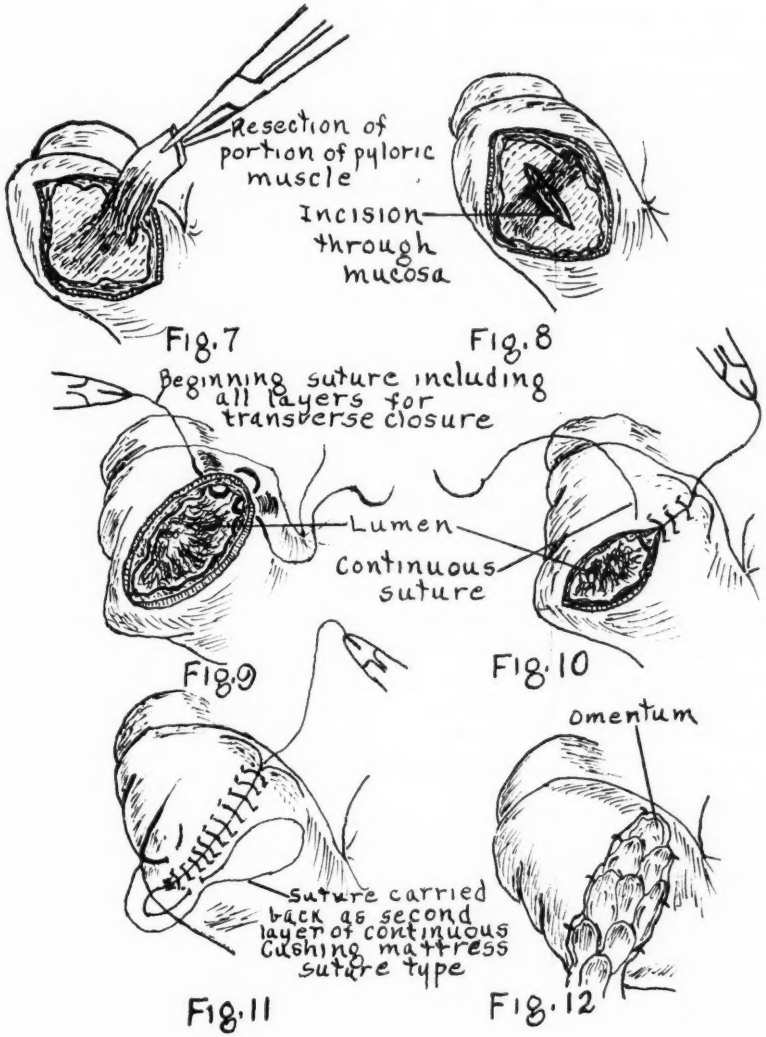

Figure 7. Resection of the anterior portion of the pyloric muscle. Figure 8. A longitudinal incision is made through the mucosa into the lumen of the duodenum and the stomach. Figure 9. Starting of the suture for closure at the superior angle through all the layers, converting the longitudinal incision into a transverse incision. Figure 10. The suture is continued as a continuous suture, for closure of the incision transversely. Figure 11. The original suture is carried back as a second layer of continuous Cushing mattress type suture. Figure 12. A portion of the gastro-colic omentum is sutured loosely over the suture line.

to the hypertrophied muscle. The hypertrophied muscle is now grasped with small clamps near the inferior edge of the serosa and muscle fibers. The muscle is cut across near the edge of the flap allowing the inferior cut portion of the muscle to retract underneath the serosa and muscle fibers forming the inferior flap (Figures 5 and 6). The superior cut portion of the muscle is grasped with small straight clamps, lifted upward and superiorly, very carefully freeing the adhesions and muscle fibers and tissue from the under surface, being cautious not to cut into the mucosal layer of the duodenum and the stomach.

After the muscle is mobilized to the superior flap of serosa and muscle fibers, the circular pyloric muscle is excised at the edge of the superior flap, and again the muscular stump is allowed to retract itself underneath the serosal-muscular flap (Figure 7). The mucosa which is now identified is grasped about midway, with two straight clamps, and a longitudinal incision 2.5 cm. is made between the clamps through the mucosa into the cavity of the duodenum and the stomach. All bleeding vessels are clamped and ligated (Figure 8). The wound is closed with atraumatic No. 00 catgut suture, which is started at the superior angle of the incision including all the layers, converting the longitudinal incision to a transverse incision. It is continued as a continuous suture to the inferior angle (Figures 9 and 10). The original catgut suture is carried back as a second layer of continuous Cushing mattress type, and tied with the loose end of the starting suture at the superior angle (Figure 11). The anterior line of sutures is covered with a portion of the gastrohepatic omentum which is sutured loosely over it with interrupted atraumatic No. 00 catgut sutures (Figure 12). The wound is closed in layers without drainage.

Summary and Discussion

1. A review of the literature of the subject of hypertrophy of the pyloric musculature with reference to pyloric stenosis without complications, or secondary to ulcer or carcinoma.

2. A description of the anatomy of the circular pyloric muscle, the origin, and distribution of the nerve supply to the pylorus and the physiology of the pylorus, as described by Cannon from the observations of his experimental work.

3. Theories concerning the etiology of hypertrophy of the pylorus in the adult are reviewed in the literature which are described by the opinions of the many authors of the subject. All have agreed to the neurogenic imbalance theory which is universally accepted. This subject due to the uncertainty of the etiology remains up to the present time an entity.

4. The history and the symptoms are classical, typical and constant, with a confirmation of the condition with the roentgenograms which are consistent with a characteristic roentgen finding of the pyloric string sign.

5. The hypertrophy of the pyloric muscle is treated by only one method; namely, surgery. The choice of operation is left with the operating surgeon as he sees fit.

6. The pathology both gross and

microscopic of the hypertrophic stenosis is virtually the same in all such cases.

7. The most significant and constant finding in the pathological study was that the majority of myenteric ganglion cells in the pylorus showed degenerative changes resembling those seen after excessive vagus nerve stimulation. Such changes are not seen in the myenteric ganglion cells in the normal individuals.

8. The author has added fourteen additional cases all of which were diagnosed as hypertrophy of the pyloric muscle with stenosis.

9. The operative procedure has been devised by the author which is demonstrated with drawings of the various stages to completion, a modification of the Heineke-Mikulicz operation.

Hypertrophy of the pyloric muscle in the adult is more prevalent than has been appreciated. The best of clinics have failed or overlooked the proper diagnosis before the patient goes to the operating room. The hypertrophy of the pylorus is not a rare or a new disease. A close observation of the history and clinical findings of the condition are constant, typical, and outstanding. The most valuable sign is one of the roentgen features which was named by Kleitsch and his associates, "pyloric string sign." This sign is constant and not obliterated by antispasmodics.

The profession should become more conscious of this condition, when ulcer medication and diets have no response, then some other condition should be suspected, other than ulcer or carcinoma.

Too many subtotal and total gastrectomies have been performed for carcinoma and ulcers that are not present.

Lastly, correct diagnosis and surgical treatment offer hope for the complete amelioration of symptoms in patients otherwise doomed to chronic invalidism and finally death due to malnutrition.

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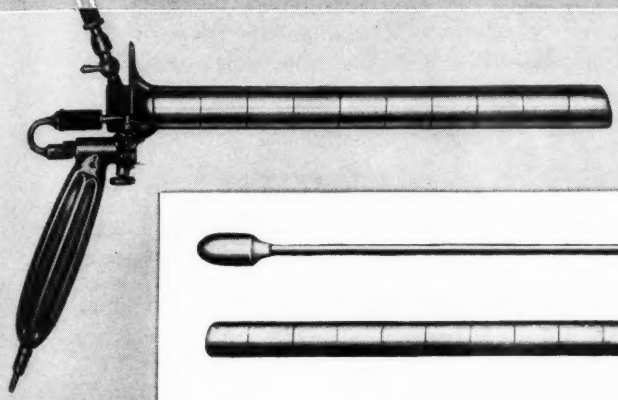

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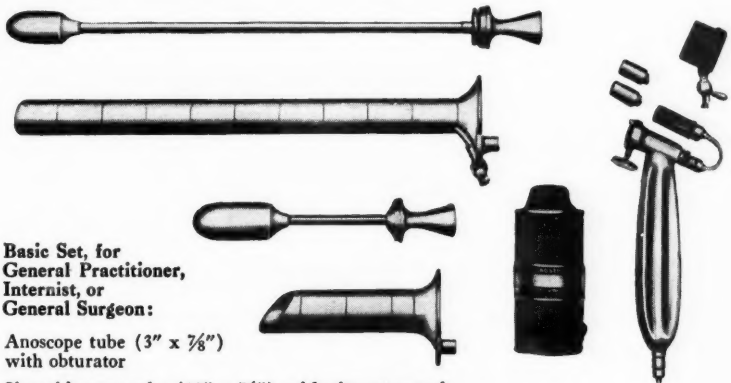

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BOOK REVIEWS

LESIONS OF THE LOWER BOWEL by Raymond J. Jackman, M.D., M.S. in Proctology, Section of Proctology, Mayo Clinic, and Associate Professor of Proctology, Mayo Foundation, Graduate School, University of Minnesota, Rochester, Minnesota. Published by Charles C. Thomas, Springfield, Illinois, U.S.A., 1958. Price $15.50.

Dr. Jackman's book offers the finest collection of color plates known to this reviewer, illustrating endoscopic photographs of intrinsic lower bowel lesions. These photographs show the normal mucosa, inflammatory ulcerative and neoplastic lesions, et cetera. In addition to the color plates there are excellent line drawings. However, the major point of departure of this volume is in terms of the endoscopic photography.

The text material is very well presented, and reflects the experience of the Mayo Clinic. The material is presented from the viewpoint of diagnosis primarily, and there is little space given to therapy. This is not a defect, but rather makes the text complementary to the already existing proctologic volumes.

The author's viewpoint throughout is to emphasize diagnosis, most particularly from the endoscopic level. As he points out, "The distal part of the bowel lends itself well to preventive measures because of its accessibility, the simplicity of examining it, and the nature of the disease processes occurring in it."

It is my belief that this volume will be useful in teaching, and as a reference work, and that it should be in the library of every proctologist.

"YEAR BOOK OF MEDICINE" (1958-1959) Edited by Paul B. Beeson, M.D., Carl Muschenheim, M.D., William B. Castle, M.D., Tinsley R. Harrison, M.D., Franz J. Ingelfinger, M.D., Philip K. Bondy, M.D. Published by The Year Book Publishers, Inc., Chicago, Illinois. Price $7.50.

This most recent "Year Book of Medicine" continues the excellent tradition of the past. It is very carefully edited, very complete in its coverage, and introduces material of value in all specialties.

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PHYSICAL EXAMINATION OF THE SURGICAL PATIENT by J. Englebert Dunphy, M.D., F.A.C.S., Professor of Surgery, Harvard Medical School; Director of 5th Surgical Service and Sears Surgical Laboratory, Boston City Hospital; Consultant in Surgery, Children's Medical Center; and Thomas W. Botsford, M.D., F.A.C.S., Clinical Associate in Surgery, Harvard Medical School; Senior Associate in Surgery, Peter Bent Brigham Hospital; Associate in Surgery, Children's Medical Center. Second Edition. Published by W. B. Saunders Company, Philadelphia, 1958. Also in London. Price $8.00.

This book will be equally useful to the general practitioner, the general surgeon, the intern, the resident, and the student.

It is an excellent discussion of physical diagnosis from the surgical viewpoint. As the reader will find, skillful palpation of abdomen, rectum, pelvis, et cetera, can be a major source of information.

Although it is basically a book of technique, the clinical evaluation of the patient as a person is not overlooked.

I would recommend this volume for its writing, its viewpoint, its excellent illustrations, and for its teaching value.

CYCLOPROPANE ANESTHESIA by Benjamin Howard Robbins, B.A., M.S., M.D. Professor of Anesthesiology and Associate Professor of Pharmacology, Vanderbilt University School of Medicine; Anesthesiologist-In-Chief Vanderbilt University Hospital. Second Edition. Published by the Williams & Wilkins Company, Baltimore, 1958. Price $9.00.

Eighteen years has elapsed between the first and second edition of this monograph. The text material is brought up to date, new figures and tables have been added, and the book becomes a useful addition to the library of the anesthesiologist. There is an excellent chapter on the relaxing agents, and the combination of relaxing agents with light Cyclopropane anesthesia, satisfies the need of the surgeon in many cases.

This is a complete monograph on the subject, the writing is good, and the anesthesiologist will welcome this book to his library.

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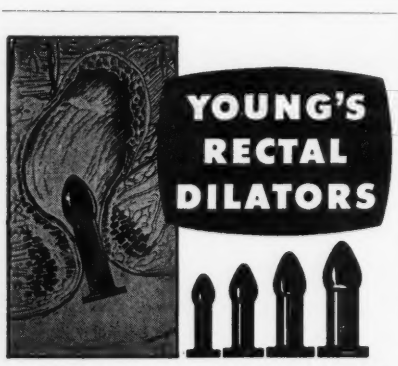

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